Questions

1. Did Döbereiner's triads also exist in the columns of Newlands' Octaves? Compare and find out.
Solution:

Döbereiner's triads did exist in the columns of Newlands' Octaves; For example, the elements Lithium (Li), Potassium (K) and Sodium (Na) constitute a Dobereiner's Triad but are also found in the second column of Newland's Octaves.

2. What were the limitations of Döbereiner's classification?
Solution:

(i) They were not applicable for very low mass or very high mass elements.

(ii) All the elements couldn't fit into Dobereiner's triads.

(iii) As the methods to calculate atomic mass improved, Dobereiner's triads validity began to decrease. For example, in the triad of F, Cl and Br, the arithmetic mean of atomic masses of F and Br are not equal to the atomic mass of CI.

3. What were the limitations of Newlands' Law of Octaves?
Solution:

- Limitations of Newlands' Law of Octaves are as follows
- Newlands' Law of Octaves applicable to elements up to Calcium
- Newland assumed there are 56 elements in the nature and no more elements would be discovered in the future.
- To fit elements into table Newland put two elements into one slot. Newland introduced unlike elements with different properties into one column.
- Iron (Fe) was placed away from elements that resembles in properties. Ex: Nickel and cobalt

1. Use Mendeleev's Periodic Table to predict the formulae for the oxides of the following elements: K, C, AI, Si, Ba.
Solution:
K- K_2O

C-C_2O_4 or CO_2

Al- Al_2O_3

Si-Si_2O_4 or SiO_2

Ba_2O_2 or BaO

Oxygen is a member of group VI A in Mendeleev's periodic table. Its valency is 2.
Similarly. The valencies of all the elements listed can be predicted from their respective groups. This will help in writing the formulae of their oxides.
(i) Potassium (K) is a member of group IA. Its valency is 1. Therefore, the formula of it is K_2O.
(ii)Carbon (C) is a member of group IV A. Its valency is 4. Therefore, the formula of it is C_2O_4 or CO_2.
(iii) Aluminium (Al) belongs to groups III A and its valency is 3. The formula of its oxide is Al_2O_3.
(iv) Silicon (Si) is present in group IV A after carbon. Its valency is also 4. The formula oxide is Si_2O_4 or SiO_2.

(v) Barium (Ba) belongs to group II A and the valency of the element is 2. The formula of oxide of the element is Ba_2O_2 or BaO.

2. Besides gallium, which other elements have since been discovered that were left by Mendeleev in his Periodic Table? (Any two)
Solution:

Germanium and Scandium are the element that are left by Mendeleev in his Periodic Table since its discovery.

3. What were the criteria used by Mendeleev in creating his Periodic Table?Solution:

Mendeleev concentrated on various compounds formed by the elements with Hydrogen and
Oxygen. Among physical properties, he observed the relationship between the atomic masses
of various elements while creating his periodic table.

4. Why do you think the noble gases are placed in a separate group?
Solution:

Noble gases are placed in a separate group because of their inert nature and low concentration in our atmosphere. They are kept in a separate group called Zero group so that they don't disturb the existing order.

1. How could the Modern Periodic Table remove various anomalies of Mendeleev's Periodic Table?
Solution:

(a) In the Modern Periodic table elements are arranged in the increasing order of their atomic number. This removes the anomaly regarding certain pairs of elements in Mendeleev's periodic table.

(b) Atomic number of cobalt is 27 and nickel is 28. Hence cobalt will come before nickel even though its atomic mass is greater.

c) All isotopes of the same elements have different atomic masses, but same atomic number; therefore they are placed in the same position in the modern periodic table.

2. Name two elements you would expect to show chemical reactions similar to magnesium. What is the basis for your choice?
Solution:

Calcium and Beryllium are similar to Magnesium because all the three elements belong to the same group and have 2 valence electrons in their outer shell.

3. Name
(a) Three elements that have a single electron in their outermost shells.
(b) Two elements that have two electrons in their outermost shells.
(c) Three elements with filled outermost shells
Solution:

(a) Lithium (Li), Sodium (Na) and potassium (k) have a single electron in their outermost shells.
(b) Magnesium (Mg) and Calcium (Ca) have two electrons in their outermost shells
(c) Neon (Ne), Argon (Ar and Xenon (Xe) filled outermost shells

(ci) a) Lithium, sodium, potassium are all metals that react with water to liberate hydrogen gas. Is there any similarity in the atoms of these elements?
(b) Helium is an unreactive gas and neon is a gas of extremely low reactivity. What, if anything, do their atoms have in common?

Solution:

They've one valence electron in their outermost shells and as a result of this, they are very unstable. So, they readily react with water to liberate hydrogen. They are also called alkali metals.

Their outermost shells are full leading to high stability. They react only in extreme circumstances and hence are called noble gases.

5. In the Modern Periodic Table, which are the metals among the first ten elements ?Solution:

Lithium and Beryllium are the metals among the first ten elements in Modern Periodic Table.

6. By considering their position in the Periodic Table, which one of the following elements would you expect to have maximum metallic characteristic ? Ga Ge As Se Be
Solution:

Among the elements listed in the question. Be and Ga are expected to be most metallic. Out of Be and Ga, Ga is bigger in size and hence has greater tendency to lose electrons than Be. Therefore, Ga is more metallic than Be.

1. Which of the following statements is not a correct statement about the trends when going from left to right across the periods of periodic Table.
(a) The elements become less metallic in nature.
(b) The number of valence electrons increases.
(c) The atoms lose their electrons more easily.
(d) The oxides become more acidic
Solution:

Correct answer is c .The atoms lose their electrons more easily.

The atoms lose their electrons more easily is a wrong statement because as we move from left to right across the periods of the periodic table, the non-metallic character increases. Therefore tendency to lose an electron decreases.

2. Element X forms a chloride with the formula XCl_2, which is a solid with a high melting point. X would most likely be in the same group of the Periodic Table as (a) Na (b) Mg (c) AI (d) Si
Solution:

Answer is Magnesium because Mg has the valency 2 which is same as the group (a) Na
(b) Mg (c) AI (d) Si
Also Mg when combines chloride forms $MgCl_2$.

3. Which element has?
(a) Two shells, both of which are completely filled with electrons?
(b) The electronic configuration 2, 8, 2?
(c) A total of three shells, with four electrons in its valence shell?
(d) A total of two shells, with three electrons in its valence shell?
(e) twice as many electrons in its second shell as in its first shell?
Solution:

a) Neon has two shells which are completely filled.
b) Silicon has the electronic configuration 2, 8, 2
c) Carbon has a total of three shells, with four electrons in its valence shell
d) Boron a total of two shells, with three electrons in its valence shell
e) Magnesium has twice as many electrons in its second shell as in its first shell

4. (a) What property do all elements in the same column of the Periodic Table as boron have in common?

(b) What property do all elements in the same column of the Periodic Table as fluorine have in common?
Solution:

(a) All the elements which lie in me same column as that of boron belong to group 13. Therefore, they have three electrons in their respective valence shells. Except, boron which is a non-metal, all other elements (i.e., aluminum, gallium, indium and thallium) in this group are metals.

(b) All elements in the same column of the Periodic Table as fluorine have in common three electrons in their valence shell and they all are belong to group thirteen.

5. An atom has electronic configuration 2, 8, 7.
(a) What is the atomic number of this element?
(b) To which of the following elements would it be chemically similar? (Atomic numbers are given in parentheses.) N(7), F(9), P(15), Ar(18)
Solution:

(a)The element with electronic configuration (2+8+7) 17 is chlorine.
The no. of atomic number = no. of electrons
Therefore, atomic number is 17.

(b)An atom with electronic configuration 2, 8, 7 would be chemically similar to F (9)

6. The position of three elements A, B and C in the Periodic Table are shown below–

Group 16	Group 17
-	-
-	A
-	-
B	C

(a) State whether A is a metal or non-metal.
(b) State whether C is more reactive or less reactive than A.
(c) Will C be larger or smaller in size than B?
(d) Which type of ion, cation or anion, will be formed by element A?
Solution:

(a) Element A is a non-metal
(b) Element C is less reactive than Element A
(c) C is smaller in size than B
(d) A will form anion

7. Nitrogen (atomic number 7) and phosphorus (atomic number 15) belong to group 15 of the Periodic Table. Write the electronic configuration of these two elements. Which of these will be more electronegative? Why?
Solution:
Atomic number of Nitrogen is 7 hence Electronic configuration of Nitrogen is $1s^2\ 2s^2\ 2p^3$ Atomic number of Nitrogen is 15 hence Electronic configuration of Phosphorous is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

On moving down a group in the periodic table, the number of shell increases. Because of which valence electrons move away from the electrons and the effective nuclear charge decreases. This causes the decrease in the tendency to attract electron and hence electro negativity decreases. Because of all these reasons Nitrogen is more electronegative than phosphorus.

8. How does the electronic configuration of an atom relate to its position in the Modern Periodic Table?
Solution:

The number of valence electrons decides an atom's position in the periodic table while the electronic configuration decides the number of valence electrons.

9. In the Modern Periodic Table, calcium (atomic number 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these have physical and chemical properties resembling calcium?
Solution:

Calcium has an atomic number of 20, and thus has an electronic configuration of 2, 8, 8, 2. Thus, calcium has 2 valence electrons. The electronic configuration of the element having atomic number 12 is 2, 8.2. Thus, this element with 2 valence electrons resemble calcium the most.

10. Compare and contrast the arrangement of elements in Mendeleev's Periodic Table and the Modern Periodic Table.

Solution:

Mendeleev's Periodic Table	**Modern Periodic Table**
Elements are arranged in the increasing order of their atomic masses.	Elements are arranged in the increasing order of their atomic numbers.
There are 8 groups	There are 18 groups
Each groups are subdivided into sub group 'a' and 'b'	Groups are not subdivided into sub-groups.
Groups for Noble gas was not present as noble gases were not discovered by that time	A separate group is meant for noble gases.
There was no place for isotopes.	This problem has been rectified as slots are determined according to atomic number.